

Information Organisation in a Community

A Corporate Portal for Spatial and Participative Monitoring

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Abstract

The spread of information has increased in recent years, due to the evolution of communication technology and the availability of multimedia electronic equipment offered on the market to disseminate information. This cheaper equipment has become increasingly accessible for the general public to acquire and use such equipment in various areas of human activity. The present study addresses the organisation of information, aiming to create a community-corporate support portal to monitor and manage the safety zones of electrical energy transmission lines. The study seeks an interaction in a virtual medium between the largest electrical energy transmission service providing company in southern Brazil and a society organised to exchange information on the occurrence of natural and anthropic phenomena in the safety zone of the Transmission Lines (TLs) and nearby areas. Developing the method has allowed for the generation of a web portal. Using continuous exploratory research, this portal allows both technical teams and the participating general population to collect data in the field concerning occurrences related to TLs. Books and reports have been consulted, and interviews have been conducted with technicians who work directly in the field of maintenance, monitoring and management defined as the TLs' safety zone.

Keywords

Information Organisation; Community-Corporate Portal; Multimedia; Safety Zone; Monitoring

Introduction

The research has an exploratory feature related to the possibilities to acquire information using technology in a multimedia environment, considering the possible use of technology in monitoring the safety zone of high-voltage electric power transmission lines (TLs).

The companies that maintain the power networks have difficulties not only at a technological level but also social level, due to their proximity to neighbouring residential populations, either in the city or the country. According to the 2010 Demographic Census which

contains the first definitive results from the 12th General Survey of Brazil (IBGE, 2010), the country has 190.7 million inhabitants. Technicians from this institute predict that the number of inhabitants will reach 215.3 million in 2050. There is also a tendency for the Brazilian population to be concentrated along the coast, precisely where the main transmission lines pass, thus increasing the risk of invading the zones. This situation negatively affects the coexistence between landowners and electric energy companies.

Company rules and governmental legislation must be followed to maintain a harmonious coexistence with the population, aiming to avoid invasion risks, proximity to some cultures and building constructions close to or under the high-voltage network. The inspectors responsible for TL maintenance and functioning must report natural hazard as soon as they occur, including fires, erosion and wind action. The linear trajectory of the TL networks is extensive; and in this study, the local community may also report risks and accidents for swift action with property defence.

A historical survey on the occurrences of accidents recorded by the Eletrosul and Celesc companies has indicated that many obstacles at a social and network management level may be minimised or even avoided if there is continued dialogue and participation in the monitoring process between the parties (the TL-managing company and the community).

However, among the occurrences that stand out as territorial stalemates, there is a prevalence of "land negotiation" cases between the landowners neighbouring the transmission lines and the electric energy utility companies. The number of stalemates in defining the territorial limits and soil use, related to the zones in the TL domain, is growing daily.

Poorly resolved agreements certainly lead to legal disputes with unforeseen outcomes. For soil use and occupation, specific consultations are also necessary on

behalf of the company managing the TLs about the licenses required to execute the maintenance procedures, in addition to work constructions in the stretches that overlap areas owned by the municipalities or in environmental preservation areas. Similarly, owners of land parcels adjacent to the TLs must consult the company about what can be planted or built under the safety zone, domain or easement.

Based on aware of a scenario that is susceptible to inappropriate occupation and the demand for urgent land management, the research project has developed and proposed an instrument that allows a calm and peaceful coexistence between society and the company managing the TL lines. The study has led to the development of an information portal called the Risk Information and Identification System (*Sistema de Informação e Identificação de Risco – SIIRIS*). The portal takes advantage of the advances in science and communication to exchange information between parties and allows exploring the technological potential of the apparatuses with multimedia devices which are currently widespread among a broad range of community members.

The main focus of this research is guided by the methodological development of an instrument on the Internet that allows continuously exchanging data and information between the company managing the TLs and civil society. A technological prototype has been generated, rooted in a developed “integration portal” between the TL managing company and civil society, which allows real-time problem identification and visualisation as well as automatic decision-making.

The employed methodology has an exploratory nature, aiming to examine some difficulties and model the support system for TL management in the course of the maintainance of the safety zones, taking the following as references:

- Data collection on the current management of the TL zones, through interviews, report queries, technical documents, literature surveys on theoretical and practical aspects of land management and the current stage of the geo-processing system used by the companies Eletrosul S.A and Celesc;
- A study of the management database system called MySQL which employs SQL (Structured Query Language) as an interface in conceiving the integration portal;

- Mastery of the programming language “Hypertext Preprocessor” (PHP);
- Google Earth images are utilized as a reference in the cartographic documentation for the integration portal.

The last option is characterised with low costs and serves as a summary for the first interaction at the territorial location of the occurrence. Visualising the cartographic data in Google Earth is a Google Maps resource that allows for visualising the same images in high spatial resolution, thereby providing easy interpretations of territorial use and occupation. The disadvantage lies in that the image is not necessarily current. However, it is the first approximation of the local reality. Figure 1 schematically illustrates the basic idea of the project, covering the interaction between the institution, i.e., the electric energy utility company, and the user who may be a landowner neighbouring the TL zone or a representative of a private or governmental institution.

The environmental question related to risk gains importance daily in the worldwide scenario, due to the increase in peoples' awareness of environmental preservation. Consequently, Brazilian environmental laws have become increasingly restrictive in deforestation licensing and implementing engineering works, thereby greatly affecting land management in the TL corridors.

Figure 1 also schematically represents the environmental context of the integration between the electric power TL-managing company and the portal users. This figure shows the scenario of the restrictions on land use and occupation to be observed by all of society; according to the civil code, the 3rd article of decree law no. 4,657 from September 4th, 1942 states “no one is excused from obeying the law by alleging that he does not know it”.

There is a need to have a channel for interactive dialogue that citizens can easily access, a dialogue that streamlines the bureaucratic procedures for environmental licenses and legislative consultations and that avoids infractions and unexpected fines. The SIIRIS system was originally designed on the premise of establishment of an efficient communication channel between citizens and TL-managing institutions through multimedia resources. The multimedia denomination is characterised by the system allowing for several media to be integrated in a virtual environment.

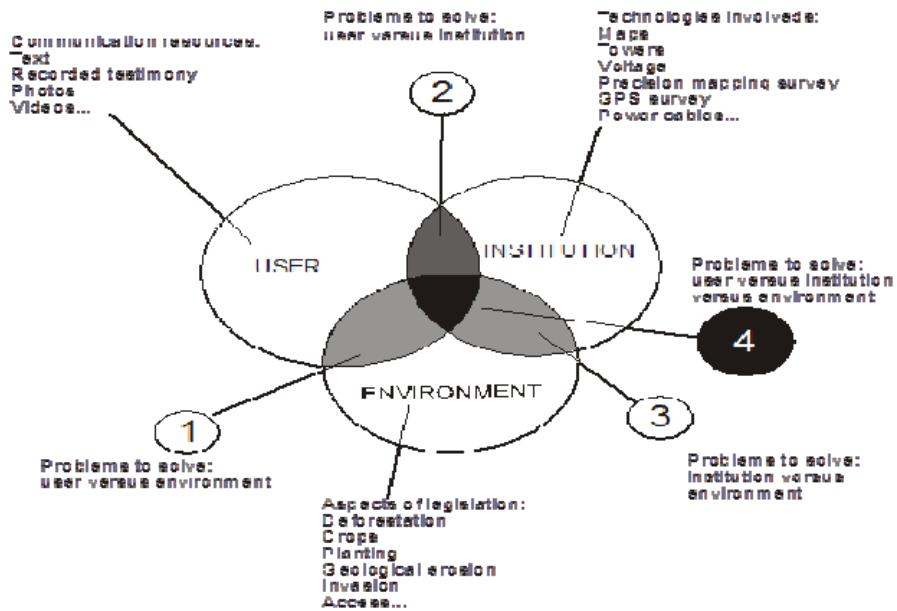


FIG. 1 MULTIMEDIA AS AN INSTRUMENT TO COMBINE CONTEXTUAL KNOWLEDGE. SOURCE: AUTHOR'S ILLUSTRATION

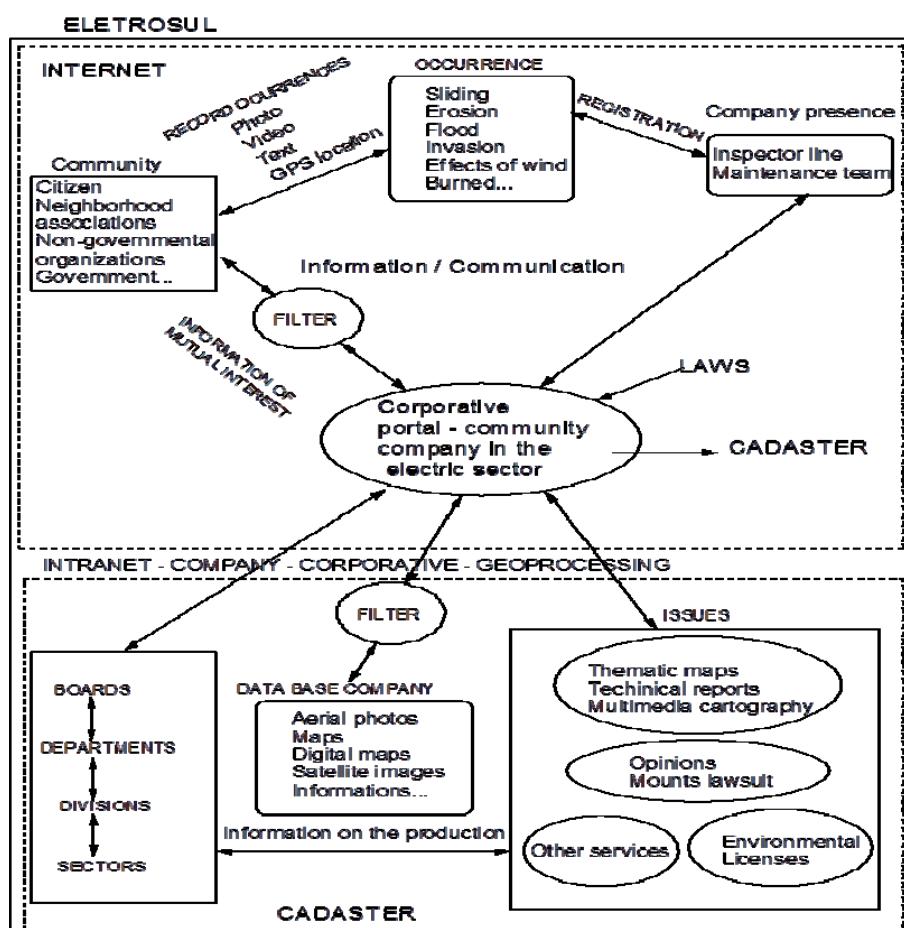


FIG. 2 ORGANISATION OF THE INFORMATION IN THE SIIRIS CORPORATE-COMMUNITY PORTAL. SOURCE: AUTHOR'S ILLUSTRATION

Figure 2 schematically shows the sources for data and information acquisition, as well as the organisation and systematisation of the flow of data and information in the internal environment of the SIIRIS corporate portal, which was developed to be available to society through an Internet module.

Figure 2 further shows that there is exclusive interest by the company Eletrosul in developing a second module that contains the same philosophy as the first but under the condition of an internal system, e.g., an intranet. In the Internet module, shown in the upper area of the figure, the actors are the citizens, neighbour associations, governmental organisations and line inspectors of the electric power company. All those who wish to collaborate can record occurrences of potential risks or accidents that have already occurred near the transmission lines. In this regard, the occurrences have an anthropic nature, e.g., invasion, burning, unsuitable agricultural crops, paths or buildings construction under the power lines and natural causes, including landslides, erosion, floods and wildfires.

The photos, videos and texts notifying or reporting the occurrence of hazards or accidents support the portal through the interfaces implemented for media devices to function. Furthermore, in the Internet module, the material obtained in the field goes through a filter to classify the information at its different levels of importance, priority and protection.

The intranet module, represented in the lower part of Figure 2, is for exclusive company use. System access is thus restricted to Eletrosul employees. As with the internet module, this module also has a filter that processes the relevant information and adds it to the database. The company's various departments and sectors can access any information from SIIRIS and be used according to their planning and/or land management needs.

The technology used in the portal allows for interactivity or efficient dialogue between the parties with greater speed, avoiding unnecessary displacements and improving the efficiency of the contact between the company and society. Several characteristics of SIIRIS are clearly observed:

- Using this interface, civil society can access data and information on environmental legislation, norms and completed legal proceedings between parties for the domain range;

- The interaction is complete, as the company may access the data and information provided by the population, who may introduce photos, videos and location maps about occurrences into the system using a cellular phone device;
- The portal provides a model available for the inter-departmental information flow in the company with exclusive use by managers. This system device allows for greater dialogue between different areas of the company; therefore, the dialogue becomes efficient. The basis for the discussion is guided by the documents that are accessible for all. This access may include access to the project, legal and environmental sectors.

SIIRIS Community-Corporate Portal

The proposal to prepare the graphic interface of the SIIRIS portal is built around information architecture principles in a simple and direct manner and to be user-friendly. This architecture is mainly related to typeface size, button arrangement, the interface routine for including announcements and visualising information related to the location where the user is navigating in the map. In the implementation phase, the system is called the SIIRIS (Sistema de Informação e Identificação de Risco) Community-Corporate Portal in light of the double function of its database, meeting both the needs of organised society and the technical needs of the company through interactive interfaces.

The participation of society groups on websites is a reality that has been the target of many scientific publications by world-renowned authors. According to Brabham (2008), this new worldwide scenario has provided a new medium for some segments of the productive sector to relate to the public better, as they are benefitted by the interactive participation of hundreds of volunteers through their websites.

In the interactivity universe that the Web provides, the SIIRIS system represents a scenario called crowdsourcing, which is characterised with the virtual relationship process of production and uses collective intelligence, as well as knowledge and volunteers scattered across the Internet, to solve problems, create content and solutions or develop new technologies.

According to Hussain and Hazarika (2011), there is a continuous explosion of geographic information generated by individuals on the Internet, who make photographs available with geo-tags and tweets,

create entries for dictionaries and geographies and update geographic databases, such as Open Street Maps (OSMs).

In their scientific study, Fritz et al. (2009) comment on the appearance of terminologies used to describe the content created by geo-spatial users, including Voluntary Geographic Information (VGI), which others also describe as crowdsourcing geodata, Neogeography, Collaborative Mapping or the wikification of the Geographic Information System (GIS). The Geo-Wiki Project uses the crowdsourcing model, to highlight the participation of Internet users in surveying the characteristics of the earth with a high degree of reliability.

The SIIRIS portal, whose working example for the occurrence of the case study is accessed through Google Chrome at the address www.siiris@ufsc.br, prioritises such participation through the graphical and textual interfaces available for the users.

Siiris Use Case Diagrams

For the SIIRIS project, diagrams have been created with the UML (Unified Modelling Language) standard. These diagrams describe the information structure and manipulation, as well as the flow of its storage, among other resources which are schematically represented in Figure 3. According to Monteiro (2004), UML is a modelling standard, but visual and not written, meaning that its designs may be coded in any programming language. As it is easy to understand, communicate and interact with this modelling, it has become widely accepted by the community of software developers, providers and manufacturers.

For the Community Corporate Portal, the representative UML model is initiated by three actors, i.e., the manager, the feeder and society. The actors in Figure 3 are drawn on the left side of the diagrams.

Actor 1, called the manager, may request two operations:

- To verify the authenticity of information in the entire system. This verification implies that the manager has the option to filter and eliminate the information that he finds invalid or edit it to make it more intelligible and useful to the system;
- To include or manage users at the feeder level, more data have been added from the informant and manage the system.

Actor 2, called the feeder, is a trained employee of the utility company who effectively has the power to execute three operations:

- To include new information in the system's database;
- To filter and eliminate redundant or invalid data and information;
- To edit the data and information.

Actor 3 is called society in the UML. This actor performs two operations within the SIIRIS system:

- Visualising the data and information available in the system;
- Updating the database, including warnings of the occurrence of some type of accident or disaster using the geographical location of the occurrence of the event as a reference.

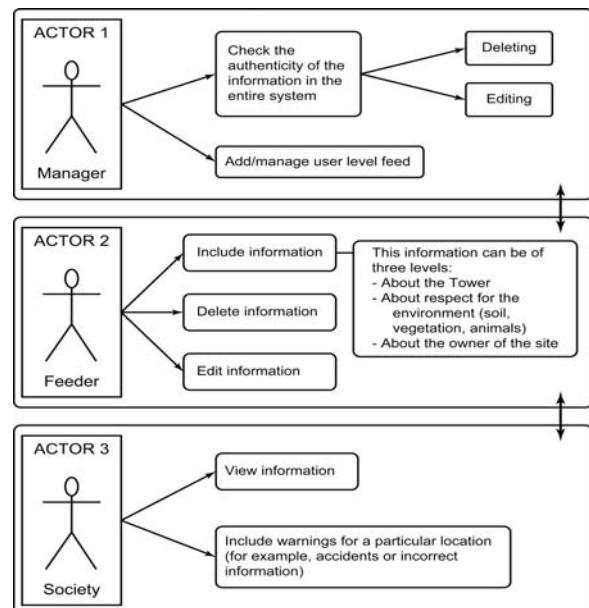


FIG. 3 DIAGRAM DEMONSTRATING THE INTERACTION OF ALL ACTORS AND THEIR FEATURES ACCORDING

The SIIRIS system was designed with open code such that the community can ensure system maintenance. All qualified persons who wish to contribute to updating or recognising adverse events that should be reported to the company managing the TL and are committed to posting true data to the system can perform this activity without any restrictions.

In addition to the above advantages, there are also advantages related to using open code. An effective gain from the adoption of open code is the system's longevity; even if the project does not undergo future updates, a code base always remains for those who

wish to develop related systems. It is thus vital during the SIIRIS planning stage to execute a study to document the code and create a space for comments in which the developers who use the database can appropriately guide themselves.

The Community Corporate Portal has been developed based on the PHP programming language and in the MySQL database as follows.

a) Programming language

The language adopted in the portal project is PHP, or "Hypertext Preprocessor". This language is an interpreted one, as it is an open-source (which is free from a licensing cost) and multiplatform language, as well possesses vast documentation and a library with functions that are extremely efficient in the time they take to consecutively execute a large amount of information. The Jquery framework is also used, which simplifies the Java Script language, facilitating code routine creation, object manipulation and using pre-defined visual effects.

b) Database interfaces

The MySQL database has been selected in its Community version because it is free and contains an open-source language. This database has an interactive style, making it possible to use many approaches to treat the information. MySQL, a database management system (DBMS) that uses the SQL language (Structure Query Language) as an resource that enables the final user to remotely access or produce new data, is currently one of the most popular databases with over 10 million installations throughout the world. The system is designed to be versatile and can be easily adapted for any reason to another type of database, including PostgreSQL which is also software with a liberal Open-Source License.

Graphic Interfaces for a Stretch of TL

To validate the proposal for the SIIRIS project, a field study has been conducted that simulated an invasion of buildings within the safety zone in a stretch of the TL for high-voltage electric power in the Rio Tavares neighbourhood in Florianópolis, Santa Catarina, Brazil. In a real situation, local inhabitants or company employees produce the digital photos and videos of the location where the "disturbance" occurred. This material should be attached to the SIIRIS portal by the AVISAR node with an annotation of the title and location of the occurrence. In this context, more local geographic references mentioned in the system provide better and more efficient technical decision-

making by the managing company's employees. The geographic coordinates and tower number thus considered data that must be input to define the occurrence of the event. The geographic coordinates and tower number are considered vital to define the location of the occurrence of the event.

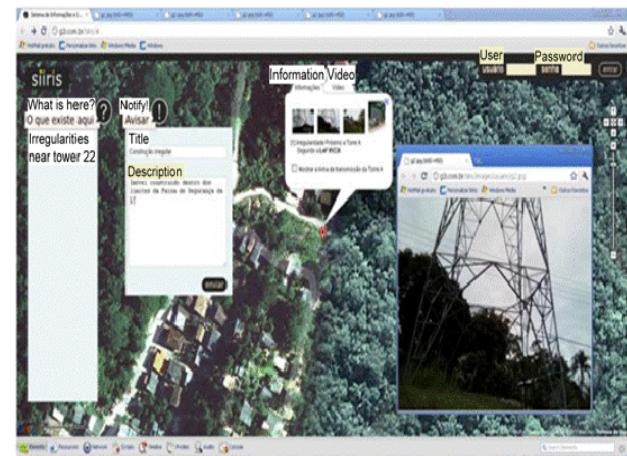


FIG. 4 SATELLITE IMAGE WITH THE LOCATION OF THE TOWER STUDIED. SOURCE: VIEW OF THE WEBSITE <http://www.siiris.ufsc.br>

At the discretion of the decision makers in the technical department of the company Eletrosul which manages the TLs, a map or Hypermap may be made according to the importance of the event.

Figure 4 represents the nodes or buttons that comprise the hypertext network of the SIIRIS portal. The photos were taken with the camera device in a cellular phone, and the videos of the lands (parcels) adjacent to the TL were taken with the same device. The recorded data in the photos and videos were incorporated into the portal to test the system's performance.

Based on the data capture and input into the SIIRIS system, it is possible to make a hypermap of the stretch of the TL zone, characterising the occurrence and visualising it a priori in real time in the office, as well as the use and occupation of the land in the area near which the recorded event occurred. In addition to system by which users are able to browse the photos and videos, users can also use a button to access the legislation relevant to the territorial domain and safety rules. The portal also contains a device that allows highlighting the cable alignments between the towers above and below the studied tower.

Another system resource developed to create an interactive interface with the user, allows the user to click on the left side of the screen, where a link titled "What's here?" is located, and establishes a direct link with the "Notify" box, in which the alleged informant

has referenced and described the occurrence. The SIIRIS system also has a navigational resource, which allows evaluating the neighbouring geography to identify the easement that leads to the tower, as the system uses the Google Earth database.

The site is not developed for anyone to access it. It is necessary to register and complete the fields that define the user and user password, located in the upper-right portion of the screen. The transmitted information regarding irregularities is immediately visualised in the format of Figure 4.

Figure 5 clearly shows the node or button that provides access to the texts on legislation. This module is expanded in importance as more information is loaded or updated, including the procedural manual, company rules, the country's technical rules and the environmental, municipal and state legislation. This resource is characterised with an important database to maintain and expand new TL networks for the company. Finally, the resource's usage is intuitive: clicking on the title or number of the law opens a new window that allows the text to be read in its entirety.

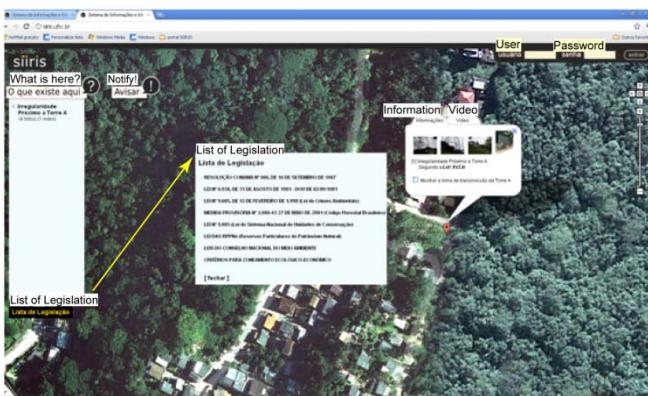


FIG. 5 BUTTON WITH A LINK FOR TEXTUAL INFORMATION ON THE LEGISLATION. SOURCE: VIEW OF THE WEBSITE <http://www.siiris.ufsc.br>

Preliminary Findings

Producing Maps Based on Information Design and Architecture

The prototype of the SIIRIS Portal is designed based on the information design and architecture techniques. According to Jacobson (1999), information design is defined as the art and science of preparing information for human use in an efficient and effective manner.

The main objectives are to develop understandable documents that are easily and swiftly recovered as well as an interaction with technical equipment in the most natural and enjoyable manner possible. For

Rosenfeld (2002), information architecture is the art and science of structuring websites and intranets to help people managing information. From this perspective, the SIIRIS Portal was designed to have efficient performance, using graphic interfaces with the option of editing thematic maps.

Because the SIIRIS Portal receives multimedia data (e.g., photos, video) sent by members of the public or maintenance teams about the occurrence of an event in a particular TL stretch, it is possible to construct a thematic hypermap, with this procedure visualised on the screen of a PDA (Personal Digital Assistant). Constructing hypermaps, as defined by Laurine and Milleret-Raffort (1989), is based on the multimedia technology applied to cartography.

Digital cartography began during the 1980s as digital copies of paper atlases, and it has evolved into geographic and multimedia information systems or simply multimedia cartography, that several authors have studied, including Cartwright and Peterson (1999) and Elzakker (1993). In the present project, map production may be aided by the community through geo-referenced data obtained with such resources cellular phone devices (e.g., photos, videos and geographic coordinates obtained from the location of the event through GPS systems). Technical teams in the respective utility departments may process this information.

Production of Textual Information

The SIIRIS uses textual interfaces to perform the interaction between organised society and the utility company, meeting the demands for information of public interest related to the safety zones. A presentation has been generated on the computer screen containing the following information:

- a) Specific legislation about preservation areas under the federal government's supervision, for cases in which the safety zone overlaps with these locations;
- b) Information on the general environmental legislation and environmental legislation specific to the areas under state protection, for cases in which the TL is subjected to this condition;
- c) Municipal environmental legislation, zoning and requirements to obtain building permits in the areas surrounding the TL;
- d) Rules from the Eletrosul company about using

safety zones, including the type of crops permitted and the minimum distance from the buildings.

Interaction with the Community

The SIIRIS portal allows exchanging data and information among the electricity service utility company, the community and other institutions, including non-governmental organisations, public institutions for environmental defence and the municipal government. Notifications of the risks of landslides, erosion and fires may involve participation from the local community based on photographs and/or videos which are acquired from digital devices and sent over the Internet by the means of computers, PDA or a cellular phone device.

Because the SIIRIS portal allows for an effective communication channel with the community as well as the availability of the aforementioned media, the portal fits within the context of the interactive multimedia principle. However, in the specific scientific bibliography on hypertext and interaction, available through the computer, there is no unanimity on the concepts defined by the authors.

According to Vaughan (1994), if the user controls "when" and "which" elements that are transmitted, then this is called interactive multimedia; if the system provides a structure of linked elements through which the user may move, the multimedia becomes hypermedia. For Cavalcante (2009), the term hypermedia means the use of text, data, graphs, audio and video in addition to any other elements that possess digital representation, in which all elements are connected and the user can move among these elements as the user desires.

Information of Specific Interest to the Company

The data and information specific to designing maps of risk areas and assembling legal processes which originate in actions from organised society, are analysed by the company's technicians who evaluate the data quality and veracity. Only after this procedure is the data made available on the intranet for the responsible departments seeking to make a specific decision. The sectors interested in the information can incorporate it into their database, which any other company sector may consult. Under the condition of internal information management, a specificity of the portal exists, with permitted queries

and query availability based on the history of event occurrences.

Conclusions

The emergence of geo-technologies based on the principle of improving data quality in geographic databases permits the precise diagnosis of the occurrence of invasions, erosion, landslides and other events in a region.

Multimedia devices that are now available and widely used by the population provide data and information for the SIIRIS portal. Such apparatuses as cellular telephones with multimedia devices, computers, video cameras, digital photography and GPS (Global Positioning System) devices, among others, thus suitable within this category. These multimedia equipments allow collecting, processing and storing spatial data on a particular area of interest; while these actions allow performing a reliable diagnosis of the event, which may be an invasion, an infraction due to unauthorised planting, damage by the weather, erosion or any other abnormality.

With the development of multimedia and its consequent application in cartography, new possibilities for research have been opened in communication and multimedia cartography research.

In the research performed on the community corporate portal, a new space has been found in academia that is open for discussion about the use of multimedia technologies, focus on the land management of electric energy transmission line zones.

The question of the user's freedom to study or alter the programme, as may be required, should follow the principle outlined by the Free Software Foundation (FSF) and Open Source Initiative (OSI), i.e., the freedom to access the source code. This is ongoing research, and more technically prepared users may collaborate in the maintenance and suggesting system improvements.

Popular participation, "crowdsourcing", has noteworthy characteristics: the motivation to volunteer and demonstrating interest in solving problems for parties. The problems emerge in matters associated with land use in relation to the TL zone.

The example of monitoring the TL zones in SIIRIS is the consequence of a doctoral thesis study in which data have been collected on this sector and an initial version of the system was generated. However, the

construction of an information portal for another purpose may be performed with appropriate adaptations based on the same scientific and technological principles used for the TL zones. It is thus possible to use the same knowledge to construct information systems to monitor highways, railways and geographic borders of states and nations.

The implementation to test and perfect the SIIRIS information system should be performed in a second stage which involves future action and is beyond the scope of this study.

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